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Bletchley Park Text: Using mobile and semantic web technologies to support the post-visit use of online museum resources

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Abstract:

A number of technologies have been developed to support the museum visitor, with the aim of making their visit more educationally rewarding and/or entertaining. Examples include PDA-based personalized tour guides and virtual reality representations of cultural objects or scenes. Rather than supporting the actual visit, we decided to employ technology to support the post-visitor, that is, encourage follow-up activities among recent visitors to a museum. This allowed us to use the technology in a way that would not detract from the existing curated experience and allow the museum to provide access to additional heritage resources that cannot be presented during the physical visit.

Within our application, called Bletchley Park Text, visitors express their interests by sending text (SMS) messages containing suggested keywords using their own mobile phone. The semantic description of the archive of resources is then used to retrieve and organize a collection of content into a personalized web site for use when they get home. Organization of the collection occurs both bottom-up from the semantic description of each item in the collection, and also top-down according to a formal representation of the overall museum story. In designing the interface we aimed to support exploration across the content archive rather than just the search and retrieval of specific resources. The service was developed for the Bletchley Park museum and has since been launched for use by all visitors.

Keywords: SMS, semantic annotation, ontology, museum visit, collecting, exploration, heritage archive.

Interactive Demonstration: Figures 8, 9 and 10 in section 3.3 are available as interactive demos of Bletchley Park Text.

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1 Introduction

In a museum context, new technology is often used either to augment, or provide a surrogate for, the physical visit. Experiments in visit augmentation include PDA-based personalized tour guides (Cheverst, Davies and Mitchell, 2002) and "smart" museum objects that can be physically manipulated by the visitor (Ferris, Bannon, Ciolfi, Gallagher, Hall and Lennon, 2004). Technologies that can be used as surrogates for a physical visit include 3D virtual reality representations of galleries and other geographical areas of cultural interest (Zára, 2004).

The post-visitor, who has recently been to the museum has, however, received less attention. Notable exceptions include work at the Exploratorium in San Francisco (Fleck, Frid, Kindberg and O'Brien-Strain, 2002; Hsi and Fait, 2005) and the Peabody Essex Museum's ARTscape (Johnson, 2004). The Exploratorium have used RFID and PDA technologies to allow a visitor to bookmark an exhibit during the physical visit and then later access related resources from the website. Similarly, ARTscape allows a visitor to bookmark exhibits using a specially adapted audio wand, and then later view further information on these from their personal collection.

Developing technology for the post-visitor is attractive for a number of reasons. Kravchyna and Hastings (2002) in a survey of visitors to a museum web site found that 57% of them visited a museum's web site both before and after a physical visit to the museum. Despite such findings, museum web sites often fail to cater for the post-visitor, instead sometimes just providing access to small digital versions of objects they have already seen for real, or information that is no longer relevant such as travel details and opening times.

Catering for the post-visitor also allows the museum to showcase held resources that cannot be appropriately displayed in the physical museum. This particularly applies to resources that would appeal to those who had already visited the museum and acquired the overall story, and that may be less meaningful to a web site visitor who has yet to attend the physical museum. Another reason for targeting the post-visitor is that encouraging follow-up activities can be very beneficial to the museum. The post-visitor may be motivated to make online purchases from the museum shop, join interest groups that promote the museum, or make a return visit.

Our approach therefore aims to formulate answers to the following questions:

- Integration: How can new technology help to thread together the visit and post-visit experience?
- Motivation: How can new technology be used to encourage the visitor to investigate a heritage domain further after the museum visit has ended?
- Exploration: How can the post-visitor be supported in exploring an archive of content associated with, but not presented, at the museum?

Our approach was developed and tested for the Bletchley Park Museum, based in Milton Keynes, UK. Bletchley Park was a wartime code breaking centre that developed the Colossus computer. In the early 1990s, it became a heritage centre focusing on the history of computing and code breaking. The museum tour describes the history of Bletchley Park, its buildings, important characters, work and inventions. As well as the exhibits and other materials made available to visitors, Bletchley Park has an extensive archive which includes hundreds of historical accounts and interviews with people connected to Bletchley Park. These were identified as the resources that would be made available after the visit.

2 Searching, browsing and collecting

Overall, we aimed to provide a service that would allow the visitor to explore an archive of resources based on interests expressed during their physical visit. This scenario produced a number of requirements that had to be borne in mind when designing the tool for accessing and using the resource archive. First, the post-visitor will probably have no prior knowledge of the content archive, and will therefore most likely be interested in exploring the range of content rather than using the content to answer specific questions that they already have. A similar requirement motivated the development of the collection understanding system of Chang, Leggett, Furuta, Kerne, Williams, Burns and Bias (2004), with which a number of paintings by an artist can be organized into a collage to give an overview of their work.

Second, because of the visitor's lack of prior knowledge of the metadata and classification schemes used by the museum to organise the content, the visitor needs sufficient scaffolding for content selection and understanding how different resources are conceptually related. Other systems have provided different types of scaffolded interfaces to metadata-annotated content. Topia (Rutledge, Alberink, Brussee, Pokraev, van Dielen and Veenstra, 2003) is a hypermedia generation system for organising components (e.g. text fragments or pictures) into a coherent presentation. The content is organised into semantically similar clusters which are then used to create a navigable presentation. Topia has been tested with content from the Rijksmuseum in Amsterdam. Yee, Swearingen, Li and Hearst (2003) developed a faceted browsing interface, whereby the user of a museum website can select resources related to particular metadata properties by selecting them from dynamically generated menus in a conventional-looking web interface. Similarly, Ontogator (Hyvönen, Saarela and Viljanen, 2004) has been used to provide a faceted browser interface, as well as a recommendation system, to a photographic repository of the Helsinki University.

Third, as the post-visitor has already expressed their interests via SMS, the web site should be clearly personalized according to these interests. This is consistent with Falk and Dierking's (2000) model of free-choice learning that grew out of large scale study of museum visitors. Free-choice learning is facilitated when individuals have control over their learning experience, including choice over what is learned and when.

Fourth, from the perspective of the museum, the interface should encourage the post-visitor to explore further and engage with the domain, rather than just take a quick look at the web site and then move on. Hsi and Fait (2005) suggest how post-visit technology could encourage further learning beyond the single physical visit.

Neither standard search or browsing interfaces can be expected to adequately meet these requirements. Search is, of course, personalized, but is more appropriate for answering specific questions and finding specific resources, rather than for open-ended exploration. Search also requires a reasonable level of domain knowledge to formulate appropriate queries. A pre-crafted or simple database driven web site for browsing the content provides more scaffolding but is not very suitable for providing a personalized experience.

Our approach, which we refer to as Spotlight Browsing, differs from the above. Here, the visitor's expressed interests are used to select a collection of resources. This collection of resources is then organized for the visitor, giving them access to the resources in the collection and also highlighting other related topics associated with the collection. This therefore contrasts with search, where the ultimate goal is to retrieve a single resource that answers the user's question. Here, the aim is to support the exploration of a resource collection and introduce additional topics for further collection-building and exploration.

This collection-based approach was motivated by a number of observations. First, the process of collecting, whether this be selecting papers from a digital library, getting information from colleagues or checking prices on the stock market, is widely seen to be an important stage in creativity and learning for which new enabling technologies should be developed (Shneiderman, 2002). Second, a collection of resources can "talk back" to the viewer, revealing interesting patterns such as commonalities, contrasts and anomalies. The collection can therefore reveal a number of properties that perhaps could not be realized from the individual items making up the collection. This idea dates back to the Gestalt Psychologists, such as Wertheimer (1924) and is often summarized in the phrase "The whole is greater than the sum of the parts".

Beliefs as to the entertainment value as well as the educational benefits of collections can also be found elsewhere. From the sixteenth to eighteenth century, a number of European households had a Wunderkammer or Cabinet of Curiosity (Putnam, 2001). These were personal collections of objects accumulated in a cabinet or dedicated room. Some collections had an emphasis on the unusual or even macabre. The Wunderkammer served as an interesting talking point for visitors to the household and was also used as a place to ruminate and reflect in order to inspire creativity.

Another characteristic of collections is that they can impose interesting challenges on the collector as to what is put in the collection and what is left out. A well known example is the Time Capsule - a box that is filled with objects in order to explain a time and/or place for people in the future who may uncover it. Constraints as to the available objects and size of the box make this an interesting challenge. Such activities have also been presented in a

museum context, for example, Peter Greenaway's 1991 exhibition entitled "100 objects to represent the world" (see Putnam, 2001).

Finally, collections of resources constitute a narrative and therefore offer a perspective that can be described as "true-ish" (Pearce, 1995) - neither true nor false but significant. By selecting some objects and organising them in a certain way, the collector or narrator is putting forward some particular viewpoint, essentially telling a story with the objects. Others may organise the collection in a different way, or select different objects to organise. Different readers of the collection may also interpret it in different ways. A selected and structured collection of objects therefore tells one of number of possible stories that can be potentially read and interpreted in a number of ways.

3 Our approach: Selection - Organization - Exploration

The process of Spotlight Browsing can be characterized as progressing through three steps: selection, organization and exploration (see figure 1). Selection involves specifying the resource collection to be explored. Organization involves structuring the collection in order that it can be effectively used. The visitor can then explore the collection in order to pursue their interests and possibly select resources for a new collection, leading to further exploration. Our overall model can be compared with Peterson and Levene's (2003) trail model of navigational learning. In their model, learning is formulated as a cyclic process that switches between stages of enacting and editing. During the enacting stage, the learner builds trails (i.e. linear pathways through learning resources). During the editing stage, the learner reflects upon the enacted trails and modifies them as a result. Their model of navigational learning views trails as being first class learning objects in their own right, as well as the resources that make up each trail.

Within our model, a collection of learning resources is also viewed as a first class learning object. One important difference in our model is that a collection of resources can be organised in a number of different structures, not only into linear pathways. Our current technical implementation incorporates the automated organisation of a collection into a number of structures, including linear pathways.

This also differentiates our work from previous post-visit technologies. These explicitly link exhibits to particular resources, providing follow-up material for that exhibit (e.g. Hsi and Fait, 2005; Johnson, 2004). In our approach, the overall collection of resources related to the chosen SMS terms is organised into a number of views. These views do not necessarily maintain a one-to-one mapping between the exhibits and the additional resources provided for follow-up.

The rest of this paper described how this approach has been instantiated in the development of Bletchley Park Text and summarises findings from a preliminary evaluation.

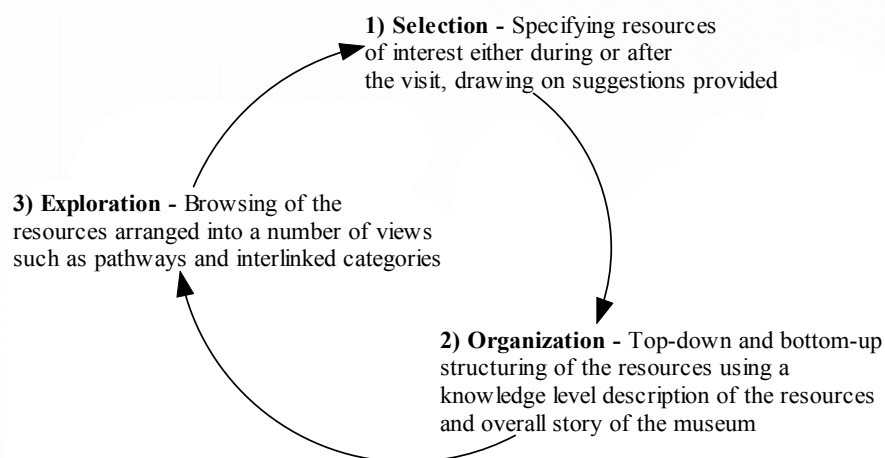


Figure 1. The steps of Spotlight Browsing: Selection, Organization and Exploration.

3.1 Step 1: Selection of terms via SMS

Selection initially occurs during the museum visit. The visitor expresses their interests by sending keywords via text message while at Bletchley Park. Keywords relate to the people, places, objects, groups and working roles associated with Bletchley Park. Suggested keywords can be found on exhibit labels (see figure 2), building signs, posters on display in Bletchley Park, a leaflet for visitors (see figure 3), and may also be suggested by the tour guide. The posters and leaflets also provide a simple step-by-step guide to Bletchley Park Text and how it should be used (see figure 4).

Prior to this stage of selection, the process of visiting the museum, viewing the exhibits and finding topic of interest can be viewed as an earlier exploration stage. In this paper we do not describe this prior exploration stage as it is not specific to our approach. Falk and Dierking (2000) provide an extensive account of how visitors explore physical museum spaces.



Figure 2. An exhibit label suggesting the keyword "bombe". Bombe was the name of the decryption machine developed by Alan Turing.

In the instructions shown on the leaflet and poster, the visitor is advised to select around five keywords. This advice is given in order to keep the resulting collection to a manageable size and also encourage the visitor to be selective as to what they would like to know more about. Previous informal tests of the software found that around five terms produce a sufficiently rich but still manageable collection of resources. Essentially, this imposes a constraint on the visitor requiring them to decide which aspects of Bletchley Park they see as most important or interesting. In total, about 150 different keywords are displayed around the site.



Figure 3. The front page of the Bletchley Park Text visitor leaflet (left) and the back page (right) giving a small number of the available keywords.



Figure 4. The middle pages of the Bletchley Park Text visitor leaflet giving step-by-step instructions on how to use the service.

3.2 Step 2: Organizing the collection

Once the visitor gets home, he or she can access their collection of resources by going to the Bletchley Park Text web site (<http://www.bletchleypark.org.uk/text>) and entering the number of the mobile phone they used to send the message. A collection of resources related to their keywords are then retrieved. The retrieval process uses the knowledge level description of each resource in the archive. An abbreviated semantic description of an historical account is shown in pseudo-code in figure 5. Each resource is represented as a story which has a number of slots. Key slots include "has central actor" (i.e. the key people or groups featured in the story), "describes physical object", "has theme" and "describes event". Each of these slots can have more than one value. The value of the "describes event" slot is, like story itself, a structure containing a set of slots. The slots of an event vary depending on its type (i.e. the subclass of event to which it belongs). Two important slots, that can be found in many subclasses of event, are "has actor" (i.e. the person or group that performs the activity) and "has recipient" (i.e. the entity at which the activity is directed). Other common slots include "has time specification" (i.e. when the event occurred) and "has location".

Returning to figure 5, this describes the story as having Alan Turing as the central character, and Bombe and Enigma machine as two physical objects that feature in the story.

The story contains two events. The first is concerned with Alan Turing's development of the Bombe machine. The second is concerned with his decryption of the enigma machine.

The collection of resources is retrieved according to the keywords in the text message. Each keyword maps to a concept used for the semantic description of the stories. A variant of the Soundex phonetic algorithm is also used to help detect mistyped keywords in the text message. The collection is made up of resources that match any of the concepts associated with the chosen keywords in the text message.

Once retrieved, the resources are organized for presentation. Two structures into which the resources are organized are pathways and categories. Shipman, Furuta, Brenner, Chung and Hsieh (1998) have demonstrated the educational benefits of organizing web pages into linear paths. Their Walden's Paths environment can be used by a teacher to organize a set of web pages into a path for use by students. The path may express some message across the collected content.

```

Story 1
Has central actor: Alan Turing
Describes physical object: Bombe,
Enigma machine
Has theme: Code-breaking
Event 1 (of type developing)
    Has actor: Alan Turing
    Has recipient: Bombe
Event 2 (of type decrypting)
    Has actor: Alan Turing
    Has recipient: Enigma
machine

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Figure 5. An abbreviated semantic description of an historical account shown in pseudo-code.

In our system, pathways are constructed automatically using the knowledge level description of the events described in the stories. Figure 6 shows a pathway from Bombe to Joan Smith involving two stories. The story containing Event 1 can be used as a starting point for a pathway from Bombe to Joan Smith as it has Bombe as a value of one of its slots. This step in the pathway takes us to Alan Turing. The relationship between Bombe and Alan Turing is generated based on the event type and the particular slots of which Bombe and Alan Turing are values. For example, as the event type is "developing" and Alan Turing is the actor and Bombe is the recipient, this is translated as "Bombe was developed by Alan Turing". A second story containing Event 3 is then used to link Alan Turing to Joan Smith. As Alan Turing and Joan Smith are both actors in this event, and the event type is "meeting", this step in the pathway is translated as "Alan Turing met with Joan Smith". In the current implementation, the shortest path between two concepts (e.g. people

or places) is generated. Other methods of path selection are under development. Currently, a path between two concepts can involve up to eight separate stories. The web-based presentation using the path structure is described later and shown in figure 8.

Story path Bombe was developed by Alan Turing. Alan Turing met Joan Smith.

**Knowledge level
description of
the events**

Story 1 containing:

Event 1 (of type developing)
actor: Alan Turing
recipient: Bombe

Story 2 containing:

Event 3 (of type meeting)
actor: Alan Turing,
Joan Smith

Figure 6. A story pathway and the semantic descriptions of its components.

Another method for organizing resources used within Bletchley Park Text is to structure the resources into a set of interlinked categories. Previous work has shown that organizing a set of resources into categories facilitates their exploration. In a longitudinal study of search engine use, Kāki (2005) found that when a user's goal is more exploratory, and less directed, organizing the results of a search into categories facilitates their use. Categories were however, not beneficial when the user was trying to find specific resources and answer specific questions. This finding aligns well with our decision to use categories in order to support the exploration of a collection of resources.

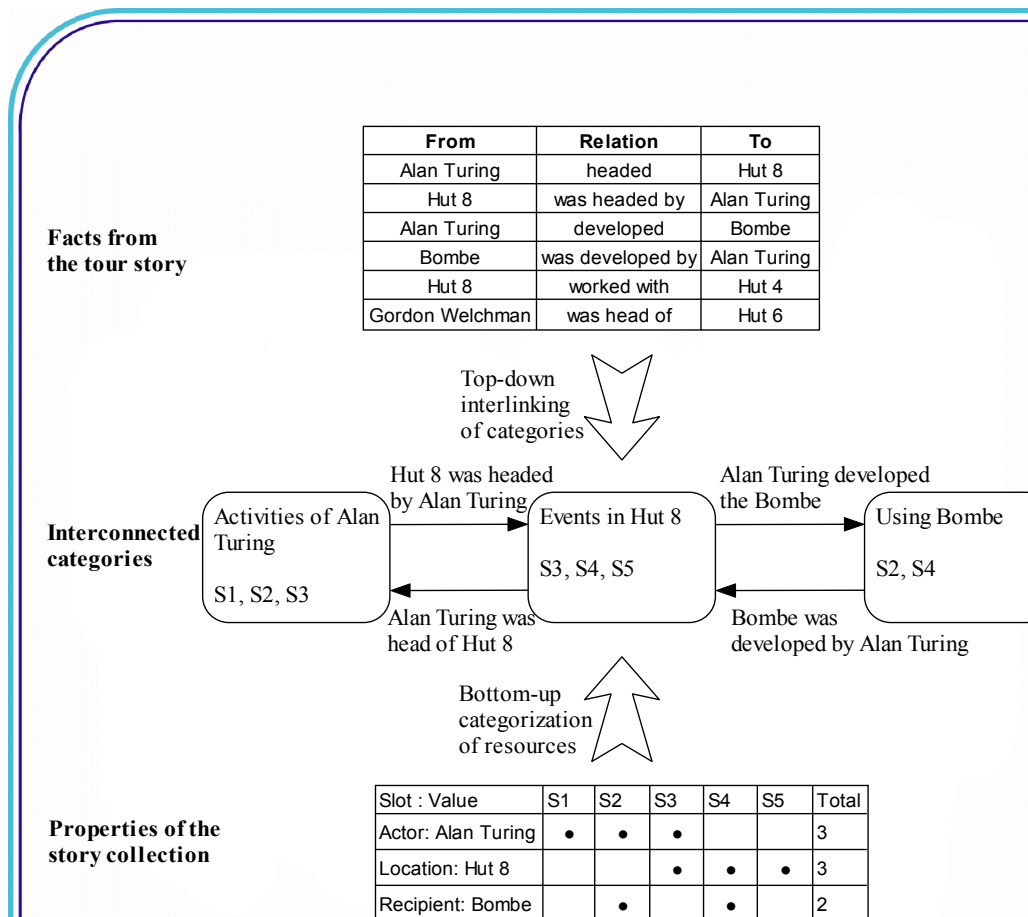


Figure 7. Organizing a collection of resources into a set of interlinked categories.

The process of generating interlinked categories is illustrated in figure 7. In this scaled down example, five stories (S1 to S5) are organized into three categories, two containing three stories and one containing two stories. Categories contain resources that have slots and values in common. In the example, the three stories containing the slot-value pair has actor: Alan Turing form a group, as do the three stories containing has location: Hut 8. For web presentation, the slot names are translated into a more readable form. Has actor becomes "Activities of" and has location becomes "Events in". To provide additional scaffolding, and explain why these categories may co-occur in a collection, the categories are interlinked using a formal representation of the tour. For this, the tour story was decomposed into a set of facts, each making a relationship between two concepts, such as "Alan Turing was head of Hut 8" and "Alan Turing developed the Bombe". These are used to link the categories Alan Turing and Hut 8. The relationship is expressed as "Alan Turing

was head of Hut 8" or conversely, "Hut 8 was headed by Alan Turing". In this organisation, resources can feature in more than one category, for example, S3 features in all three categories. An alternative organisation, also featured in Bletchley Park Text, organises the resources hierarchically in order that each resource features in only one category.

The story categories are therefore created bottom-up from the collection, but the links between the categories are created top-down from the museum tour. The web-based presentation using the above interlinked category structure is described later and shown in figure 9.

3.3 Step 3: Exploring the collection

Once retrieved and organized, the collection of resources is presented for exploration by the visitor. A number of different views on the collection are provided. One option allows the visitor to make pathways through the resource collection that connect concepts mentioned in their SMS message (see figure 8). In this example, the visitor has chosen five concepts: Alan Turing, Stony Stratford, Block F and Heath Robinson Machine. Using the pull-down menu on the left hand side, the visitor selects which of the five concepts they would like to connect. A pathway connecting the two concepts is then generated. In figure 8, a pathway connecting Alan Turing to Stony Stratford is shown. This required two stories. The first story connects Alan Turing to Hut 7. The second story connects Hut 7 to Stony Stratford. The visitor can read one of the stories in full by clicking on its title.

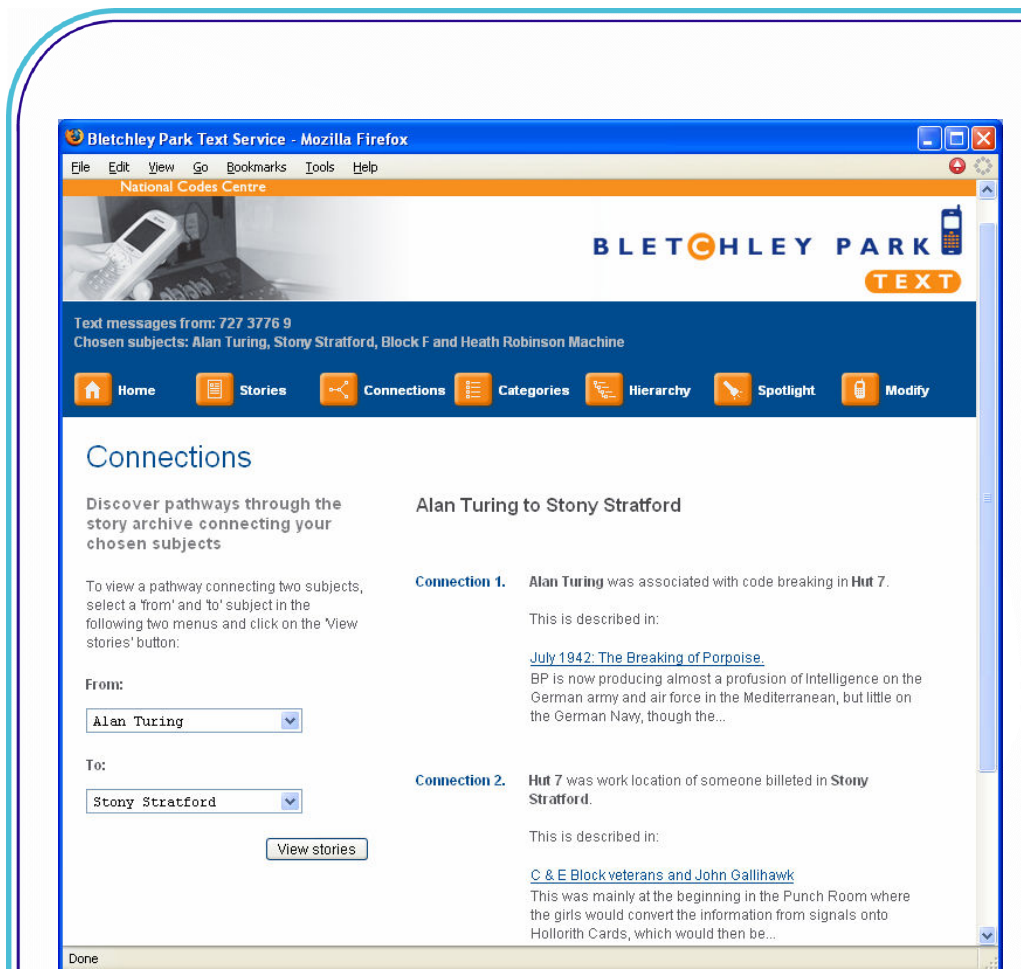


Figure 8. Making pathways through the stories by selecting concepts from the SMS message. An interactive version of this figure is available at <http://cipherweb.open.ac.uk/connections.php>.

A further option organizes the collection into a number of interlinked categories (see figure 9). The categories are shown on the left. To the right of this are the summaries of the stories that belong to the selected category. The shaded box shown to the top-right shows links between this category and other available categories within the collection. In the figure, the selected category is "Events in Block F". This has links to two other categories within the collection. These links are to Colossus (that was used in Block F) and the Newmanry (a group a workers based in Block F).

As can be seen, many of these categories feature concepts that were not in the visitor's text message (e.g. the Newmanry). However, these concepts co-occur in the collection of stories

about their chosen topics. They are therefore of possible interest to the visitor, and it is also likely that, in gaining a knowledge of their chosen terms, the visitor will develop some appreciation of these additional related concepts.

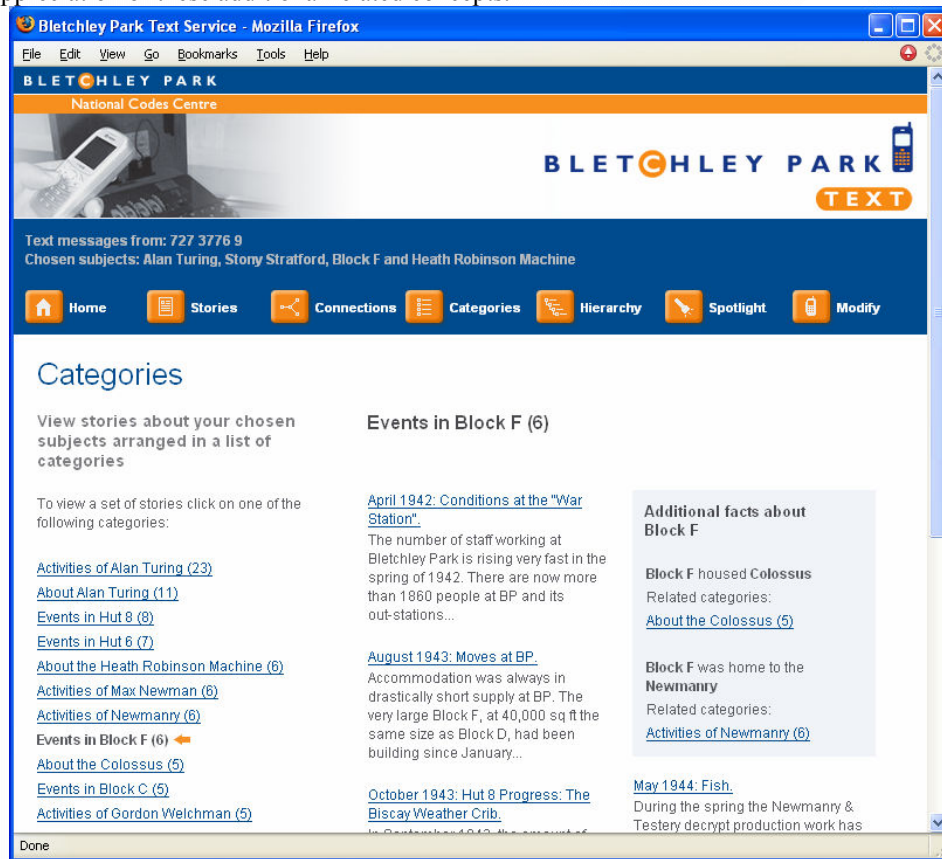


Figure 9. The collection of stories organized into interlinked categories. An interactive version of this figure is available at <http://cipherweb.open.ac.uk/categories.php>.

Another version of the interlinked category view separates out categories as to whether or not they are directly related to the concepts contained in the visitor's SMS message (see figure 10). This is represented using a torch metaphor. Categories directly related to the text message are shown in the bright area of the torchlight. For example, the category "Activities of Alan Turing" is included here as Alan Turing was one of the topics included in their text message. The most commonly occurring categories not directly related to the text message are shown underneath, at the edge of the torchlight. This view was designed in

order to draw the visitor's attention to topics in which they did not express an interest but which are closely associated with the concepts in their text message. This is intended to encourage the visitor to explore further, beyond the confines of their specified collection, or, following the metaphor, encourage them to move the torchlight to another area of the archive.

Once again the visitor can read any story by clicking on its title. Links between the selected category and other categories are shown in the shaded box displayed to the top right of the screen.

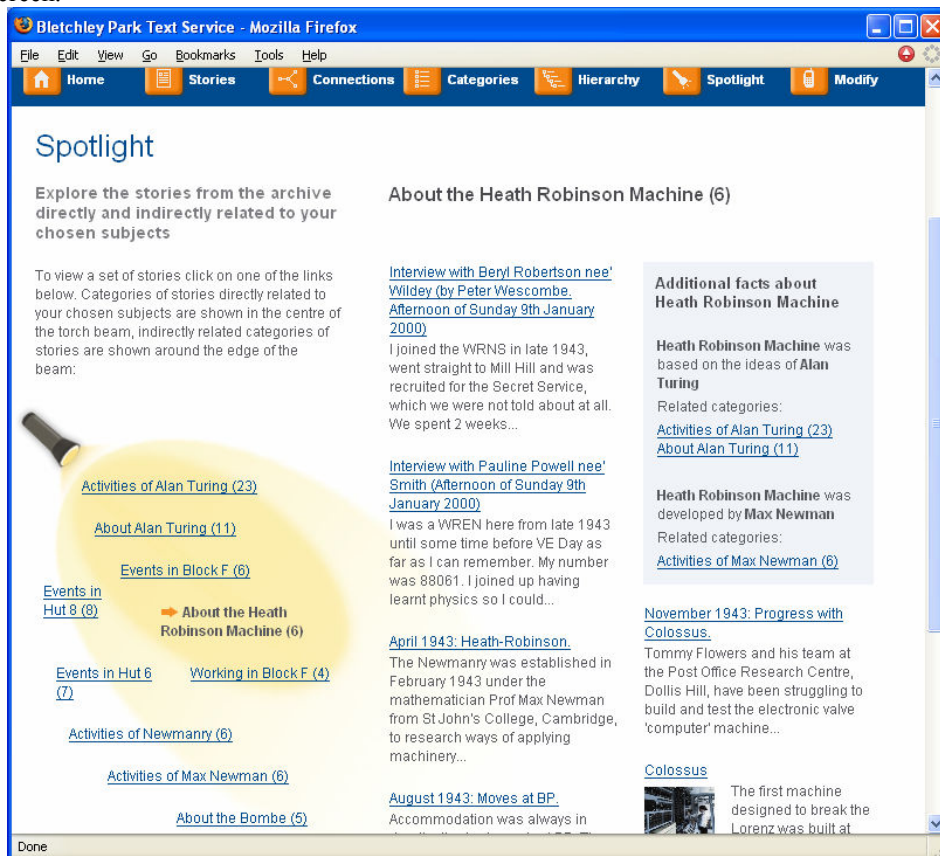


Figure 10. The collection organized into categories directly and indirectly related to the keywords in the text message. An interactive version of this figure is available at <http://cipherweb.open.ac.uk/spotlight.php>.

3.4 Step 1 revisited: Selecting new terms via the web site

The final option available to the visitor allows them to modify their selected terms (see figure 11). The box to the top left shows the originally selected topics in an editable text area. The visitor can delete any of these that they wish to remove from their collection. Just below this, topics are suggested that statistically co-occur with the chosen topics. Up to six of these are shown. This list of suggestions is therefore generated bottom-up from the current collection. Further down the left hand side of the screen are new topics related to the original topics by the fact representation of the tour. For example, the topic "Bombe" is suggested here as Alan Turing developed the Bombe. This second list of suggestions is therefore generated top-down from the tour facts.

There is often some overlap between the topics suggested top-down and those suggested bottom-up. In figure 11, Max Newman features on both lists of suggestions. He is included on the first list because he featured in a large number of stories within the current collection. He is included on the second list because a tour fact links him to Alan Turing and Alan Turing was included as a topic in the original message. Any differences between the suggested topics generated top-down and bottom-up are left to the visitor to ponder. The current system does not resolve these differences for the user.

If the visitor wishes to move conceptually further away from their current collection, a larger list of approximately 650 topics is presented on the right of the screen. This is shown in order to give the visitor an appreciation of the scale of the overall content. It is also provided to provoke curiosity and make them wonder what these topics mean and what resources may be revealed if they are selected. Consistent with the instructions provided during the physical visit, the visitor is advised to select about five topics and is allowed a maximum of nine.

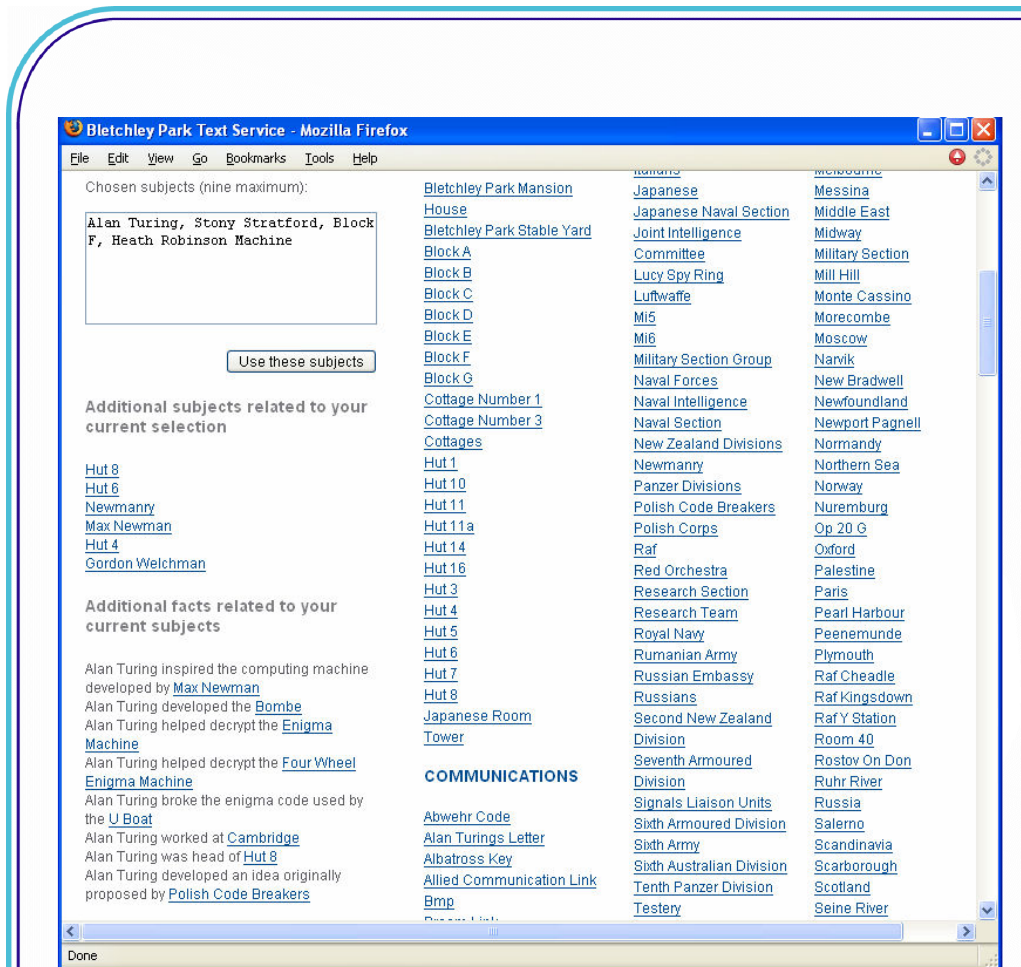


Figure 11. Choosing a new set of keywords.

From a HCI perspective, the interface for selecting a new collection has some unusual features:

- Constrained choices: The visitor can only select five topics but is presented with over 650 to choose from.
- Uninformed decision making: The visitor may not know whether they would be interested in reading about some unknown topic, but the only way to find out is to select it.
- Unresolved inconsistencies: Differences between the top-down and bottom-up generated suggestions are left unresolved for the visitor to consider.

These features also partly characterize the initial selection of topics during the physical visit. These characteristics do not help the user retrieve efficiently information from the

archive, however that was never the goal. Efficient retrieval and the selection of specific resources is served by search engines. The aim here was to provide resources of interest but also provoke curiosity and encourage further engagement with the content. The above characteristics seem promising when the goal is curiosity rather than efficiency. Gaver, Beaver and Benford (2003) argue the case for designing ambiguity into human computer interfaces in order to motivate engagement and active interpretation by the user. They argue that although ambiguity can be frustrating it can also be "intriguing, mysterious and delightful". An important trade-off in such interfaces is to ensure that the frustration level is not too high, and is paid off by the positive qualities of this form of interaction.

4 Preliminary evaluation

A preliminary evaluation of Bletchley Park Text, described in more detail in Mulholland, Collins and Zdrahal (2005), was carried out in participation with a group of 35 pupils from a local secondary (post 11) school. A short presentation about Bletchley Park Text was given at the beginning of their visit and each was given a leaflet containing about 150 possible text terms, organised into people, places and objects. The pupils then spent around three hours exploring Bletchley Park with the help of a tour guide. During the visit, all were able to send text messages and 20 of the pupils accessed the web site in their free time. A volunteer group of six pupils used Bletchley Park Text to help them write an essay. The topics of the essays included the ideas of Alan Turing, the Bombe decryption machine, and methods used for the decryption of naval communications. An analysis of these essays showed that they included concepts that were not presented during the physical visit and drew on multiple stories from the archive. Overall, the study showed that Bletchley Park Text could be used, that the pupils found this method of accessing and using the content enjoyable, and that it played a part in developing a continuing interest in the topic. For example, one of the six volunteer pupils asked for reassurance that his account on Bletchley Park Text would be preserved so that he could continue to use it, and another two has acquired books related to their essay topic for further follow-up in their free time. Further studies will compare the approach against more traditional searching and browsing interfaces and the relative role played by each of the views on the collection provided in the interface.

5 Conclusions

Bletchley Park Text is an instantiation of a novel approach to the exploration of an archive of resources, called Spotlight Browsing. This allows the user to specify a collection of interest, have it automatically organized into pathways and interconnected categories, explore the collection, and then redefine the collection in order to explore further. Bletchley Park Text was launched as a visitor service in May 2005. Future work will involve establishing the scalability and generality of the approach, to determine whether, and under what conditions, Spotlight Browsing can support the exploration of other content archives.

6 Acknowledgements

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7 References

- Chang, M., Leggett, J., Furuta, R., Kerne, A., Williams, J., Burns, S., and Bias, R. (2004). Collection understanding. *Proceedings of the Joint Conference on Digital Libraries (JCDL '04)*, Tucson, Arizona.
- Cheverst, K., Davies, N., and Mitchell, K. (2002). The Role of Adaptive Hypermedia within a Context-Aware Tourist GUIDE. *Communications of the ACM*, 45 (5), 47-51.
- Falk, J. H. and Dierking, L. D. (2000). *Learning from museums: Visitor experiences and the making of meaning*. Rowman and Littlefield: Walnut Creek, CA.
- Ferris, K., Bannon, L., Ciolfi, L., Gallagher, P., Hall, T., and Lennon, M. (2004). Shaping Experiences in the Hunt Museum: A Design Case Study. *Proceedings of the ACM Conference on Designing Interactive Systems (DIS '04)*, Cambridge, MA.
- Fleck, M., Frid, M., Kindberg, T. and O'Brien-Strain, E. (2002). Rememberer: A tool for capturing museum visits. Technical report HPL-2002-187. HP Labs.
- Gaver, W., Beaver, J., and Benford, S. (2003). Ambiguity as a resource for design. *Proceedings of the ACM SIGCHI conference on Human factors in computing systems (CHI '03)*, Ft. Lauderdale, Florida.
- Hsi, S. and Fait, H. (2005). RFID enhances visitors' museum experience at the Exploratorium. *Communications of the ACM*, 48 (9), 60-65.
- Hyvönen, E., Saarela, S. and Viljanen, K. (2004). Application of ontology techniques to view-based semantic search and browsing. *Proceedings of the First European Semantic Web Symposium (ESWS '04)*, Heraklion, Greece.
- Johnson, B. (2004). Beyond on-line collections: Putting objects to work. *Museums and the Web 2004*, Washington DC.
- Kravchyna, V. and Hastings, S.K. (2002). Informational Value of Museum Web Sites. *First Monday*, 7 (2). URL: http://firstmonday.org/issues/issue7_2/kravchyna/index.html.
- Käki, M. (2005). Findex: Search result categories help users when document ranking fails. In *Proceedings of the ACM SIGCHI conference on Human factors in computing systems (CHI '05)*, Portland, Oregon.
- Mulholland, P., Collins T., and Zdrahal, Z. (2005). Spotlight browsing of resource archives. *Proceedings of the ACM Conference on Hypertext and Hypermedia (HT '05)*, Salzburg, Austria.
- Pearce, S. M. (1995). *On collecting: An investigation into collecting in the European tradition*. Routledge: London.
- Peterson, D. and Levene, M. (2003). Trail records and navigational learning. *London Review of Education*, 1, (2003), 207-216.

- Putnam, J. (2001). *Art and Artifact: The Museum as Medium*. Thames & Hudson: London, UK.
- Rutledge, L., Alberink, M., Brussee, R., Pokraev, S., van Dieten, W. and Veenstra, M. (2003). Finding the story - Broader applicability of semantics and discourse for hypermedia generation. *Proceedings of the ACM Conference on Hypertext and Hypermedia (HT '03)*, Nottingham, UK.
- Shipman, F., Furuta, R., Brenner, D., Chung, C. and Hsieh, H. (1998). Using paths in the classroom: experiences and adaptations. *Proceedings of the ACM Conference on Hypertext and Hypermedia (HT '98)*, Pittsburgh, Pennsylvania.
- Shneiderman, B. (2002). *Leonardo's Laptop: Human Needs and New Computing Technologies*. MIT Press: Cambridge, MA.
- Wertheimer, M. (1924). Gestalt theory. English translation in Ellis, W. D. (Ed.) (1939). *A Source Book of Gestalt Psychology*. Harcourt Brace: New York. Available from the Gestalt archive, URL: <http://gestalttheory.net/archive>.
- Yee, K.-P., Swearingen, K., Li, K. and Hearst, M. (2003). Faceted metadata for image search and browsing. *Proceedings of the ACM SIGCHI conference on Human factors in computing systems (CHI '03)*, Ft. Lauderdale, Florida.
- Zára, J. (2004). Virtual Reality and Cultural Heritage on the Web. *Proceedings of the 7th International Conference on Computer Graphics and Artificial Intelligence*, Limoges, France.